

# DEPARTMENT OF CONSUMER & INDUSTRY SERVICES

## DIRECTOR'S OFFICE

### CONSTRUCTION SAFETY STANDARDS

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(By authority conferred on the director of the department of consumer and industry services by sections 19 and 21 of Act No. 154 of the Public Acts of 1974, as amended, and Executive Reorganization Order No. 1996-2, being §§408.1019, 408.1021, and 445.2001 of the Michigan Compiled Laws)

R 408.41634 of the Michigan Administrative Code is effective as of the date of this amendment.

## PART 16. POWER TRANSMISSION AND DISTRIBUTION

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#### **R 408.41601. Application.**

**Rule 1601.** (1) The occupational safety and health standards contained in this part apply to the construction of electric transmission and distribution lines and equipment.

(2) As used in this part, the term "construction" includes the erection of new electric transmission and distribution lines and equipment and the alteration, conversion, and improvement of existing electric transmission and distribution lines and equipment.

(3) Existing electric transmission and distribution lines and electrical equipment need not be modified to conform to the requirements of applicable standards in this part until such work as described in subrule (2) of this rule is to be performed on such lines or equipment.

(4) The standards set forth in this part provide minimum requirements for safety and health. Employers may require adherence to additional standards which are not in conflict with the standards contained in this part.

(5) This standard does not apply to communication lines as defined in R 408.41625(10).

#### **R 408.41625. Definitions.**

**Rule 1625.** (1) "Alive or live (energized)" means electrically connected to a source of potential difference or means electrically charged so as to have a potential

significantly different from that of the earth in the vicinity. The term "live" is sometimes used in place of the term "current-carrying," where the intent is clear, to avoid repetition of the longer term.

(2) "Automatic circuit recloser" means a self-controlled device for automatically interrupting and reclosing an alternating current circuit with a predetermined sequence of opening and reclosing followed by resetting, hold closed, or lock-out operation.

(3) "Barricade" means a physical obstruction such as tapes, screens, or cones intended to warn and limit access to a hazardous area.

(4) "Barrier" means a physical obstruction which is intended to prevent contact with energized lines or equipment.

(5) "Bond" means an electrical connection from one conductive element to another for the purpose of minimizing potential differences or providing suitable conductivity for fault current or for mitigation of leakage current and electrolytic action.

(6) "Bushing" means an insulating structure including a through conductor, or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

(7) "Cable" means a conductor with insulation or a stranded conductor with or without insulation and other coverings (single-conductor cable) or a combination of conductors insulated from one another (multiple-conductor cable).

(8) "Cable sheath" means a protective covering applied to cables. A cable sheath may consist of multiple layers of which one or more is conductive.

(9) "Circuit" means a conductor or system of conductors through which an electric current is intended to flow.

(10) "Communication lines" means the conductors and their supporting or containing structures which are used for public or private signal or communication service, which operate at potentials not exceeding 400 volts to ground or 750 volts between any 2 points of the circuit, and the transmitted power of which does not exceed 150 watts. When operating at less than 150 volts no limit is placed on the capacity of the system. Telephone, telegraph, railroad signal, data, clock, fire, police-alarm, community television antenna, and other systems conforming with the above are examples of communication lines. Lines used for signaling purposes, but not including under the above definition, are considered as supply lines of the same voltage and are to be so run.

(11) "Conductor" means a material, usually in the form of a wire, cable, or bus bar, suitable for carrying an electric current.

(12) "Conductor shielding" means an envelope which encloses the conductor of a cable and provides an equipotential surface in contact with the cable insulation.

(13) "Current-carrying part" means a conducting part intended to be connected in an electric circuit to a source of voltage. Non-current-carrying parts are those not intended to be so connected.

(14) "Dead (deenergized)" means free from any electrical connection to a source of potential difference and from electrical charges: not having a potential difference from that of earth. The term is used only with reference to current-carrying parts which are sometimes alive (energized).

(15) "Designated employee" means a qualified person delegated to perform specific duties under the conditions existing.

(16) "Effectively grounded" means intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the buildup of voltages which may result in undue hazard to connected equipment or to persons.

(17) "Electric line truck" means a truck used to transport men, tools, and material and to serve as a traveling workshop for electric power line construction and maintenance work. It is sometimes equipped with a boom and auxiliary equipment for setting poles, digging holes, and elevating material or men.

(18) "Electric supply lines" means those conductors used to transmit electric energy and their necessary supporting or containing structures. Signal lines of more than 400 volts to ground are always supply lines within the meaning of the rules, and those of less than 400 volts to ground may be considered as supply lines, if so run and operated throughout.

(19) "Enclosed" means surrounded by a case, cage, or fence which will protect the contained equipment and prevent accidental contact of a person with live parts.

(20) "Equipment" means a general term which includes fittings, devices, appliances, fixtures, apparatus, and the like, used as part of, or in connection with, an electrical power transmission and distribution system, or communication systems.

(21) "Exposed" means not isolated or guarded.

(22) "Ground (reference)" means that conductive body, usually earth, to which an electric potential is referenced.

(23) "Ground (as a noun)" means a conductive connection whether intentional or accidental, by which an electric circuit or equipment is connected to reference ground.

(24) "Ground (as a verb)" means the connecting or establishment of a connection, whether by intention or accident, of an electric circuit or equipment to reference ground.

(25) "Grounded conductor" means a system or circuit conductor which is intentionally grounded.

(26) "Grounded system" means a system of conductors in which at least 1 conductor or point (usually the middle wire, or neutral point of transformer or generator windings) is intentionally grounded, either solidly or through a current-limiting device (not a current-interrupting device).

(27) "Grounding electrode (ground electrode)" means a conductor embedded in the earth, used for maintaining ground potential on conductors connected to it, and for dissipating into the earth current conducted to it.

(28) "Grounding electrode conductor (grounding conductor)" means a conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode.

(29) "Grounding electrode resistance" means the resistance of the grounding electrode to earth.

(30) "Guarded" means protected by personnel, covered, fenced, or enclosed by means of suitable casings, barrier rails, screens, mats, platforms, or other suitable devices in accordance with standard barricading techniques designed to prevent dangerous approach or contact by persons or objects. Wires which are insulated but not otherwise protected are not considered as guarded.

(31) "Hotline tools and ropes" means those tools and ropes which are especially designed for work on energized high voltage lines and equipment. Insulated aerial equipment especially designed for work on energized high voltage lines and equipment shall be considered hotline.

(32) "Insulated" means separated from other conducting surfaces by a dielectric substance (including air space) offering a high resistance to the passage of current. When any object is said to be insulated, it is understood to be insulated in suitable manner for the conditions to which it is subjected. Otherwise, it is within the purpose of this subpart, uninsulated. Insulating covering of conductors is one means of making the conductor insulated.

(33) "Insulated (as applied to cable)" means that which is relied upon to insulate the conductor from other conductors or conducting parts or from ground.

(34) "Insulation shielding" means an envelope which encloses the insulation of a cable and provides an equipotential surface in contact with cable insulation.

(35) "Isolated" means an object that is not readily accessible to persons unless special means of access are used.

(36) "Manhole" means a subsurface enclosure which personnel may enter and which is used for the purpose of installing, operating, and maintaining equipment or cable or both.

(37) "Pulling tension" means the longitudinal force exerted on a cable during installation.

(38) "Qualified person" means a person who by reason of experience or training is familiar with the operation to be performed and the hazards involved.

(39) "Switch" means a device for opening and closing or changing the connection of a circuit. In these rules, a switch is understood to be manually operable, unless otherwise stated.

(40) "Tag" means a system or method of identifying circuits, systems, or equipment for the purpose of alerting persons that the circuit, system, or equipment is being worked on.

(41) "Unstable material" means earth material, other than running, that, because of its nature or the influence of related conditions, cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.

(42) "Vault" means an enclosure above or below ground which personnel may enter and is used for the purpose of installing, operating, or maintaining equipment or cable, or both.

(43) "Voltage" means the effective or root mean squared potential difference between any 2 conductors or between a conductor and ground. Voltages are expressed in nominal values. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of this system may vary above or below this value.

(44) "Voltage of a circuit not effectively grounded" means the voltage between any 2 conductors. If 1 circuit is directly connected to and supplied from another circuit of higher voltage (as in the case of an auto-transformer), both are considered as of the higher voltage, unless the circuit of lower voltage is effectively grounded, in which case its voltage is not determined by the circuit of higher voltage. Direct connection implies electric connection as distinguished from connection merely through electromagnetic or electrostatic induction.

(45) "Voltage of an effectively grounded circuit" means the voltage between any conductor and ground, unless otherwise indicated.

#### **R 408.41626. Initial inspections, tests, or determinations.**

**Rule 1626.** (1) Existing conditions shall be determined before starting work by an inspection or a test. Such conditions shall include, but not be limited to, energized lines and equipment, conditions of poles, and the location of circuits and equipment, including power and communication lines, CATV, and fire alarm circuits.

(2) Electric equipment and lines shall be considered energized until determined to be deenergized by tests or other appropriate methods or means.

(3) Operating voltage of equipment and lines shall be determined before working on or near energized parts.

#### **R 408.41627. Clearances.**

**Rule 1627.** (1) The following provisions of subdivision (a), (b), or (c) of this subrule shall be observed:

- (a) An employee shall not be permitted to approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in table 1, unless 1 of the following is complied with:

- (i) The employee is insulated or guarded from the energized part. Gloves or sleeves with sleeves rated for the voltage involved, which are provided for pursuant to rules 617 and 641 of construction safety standard, Part 6. Personal Protective Equipment, being R 408.40617 and R 408.40641 of the Michigan Administrative Code, shall be considered insulation of the employee from the energized part. The work method on parts energized above 5,000 volts phase to ground shall be with rubber gloves and sleeves out of an insulated bucket, by the use of hot line tools, or with rubber gloves and sleeves in conjunction with a factory-made

and approved insulated platform that provides a method of belting off other than to the pole or structure. This rule does not apply to the bare-hand technique.

- (ii) The energized part is insulated or guarded from the employee and any other conductive object at a different potential.
  - (iii) The employee is isolated, insulated, or guarded from any other conductive object, as during live-line, bare-hand work.
- (b) The minimum working distance and minimum clear hot stick distances stated in table 1 shall not be violated. The minimum clear hot stick distance is that for the use of live-line tools held by linemen when performing live-line work.
  - (c) Conductor support tools, such as line sticks, strain carriers, and insulator cradles, may be used provided that the clear insulation is at least as long as the insulator string or the minimum distance specified in table 1 for the operating voltage.
- (2) Table 1 reads as follows:

TABLE 1  
Alternating Current – Minimum Distances

<i>Voltage range (phase to phase) kilovolt</i>	<i>Minimum working and clear hot stick distance</i>
2.1 to 15	2 ft. 0 in.
15.1 to 35	2 ft. 4 in.
35.1 to 46	2 ft. 6 in.
46.1 to 72.5	3 ft. 0 in.
72.6 to 121	3 ft. 4 in.
138 to 145	3 ft. 6 in.
161 to 169	3 ft. 8 in.
230 to 242	5 ft. 0 in.
345 to 362	<sup>1</sup> 7 ft. 0 in.
500 to 552	<sup>1</sup> 11 ft. 0 in.
700 to 765	<sup>1</sup> 15 ft. 0 in.

<sup>1</sup>NOTE: For 345-362 kv., 500-552 kv., and 700-765 kv., the minimum working distance and the minimum clear hot stick distance may be reduced provided that such distances are not less than the shortest distance between the energized part and a grounded surface.

#### **R 408.41628. Deenergizing lines and equipment.**

**Rule 1628.** (1) When deenergizing lines and equipment operated in excess of 600 volts, and the means of disconnecting from electric energy is not visibly open or visibly locked out, the provisions of subdivisions (a) to (g) of this subrule shall be complied with:

- (a) The particular section of line or equipment to be deenergized shall be clearly identified, and it shall be isolated from all sources of voltage.
- (b) Notification and assurance from the designated employee shall be obtained that:
  - (i) All switches and disconnectors through which electric energy may be supplied to the particular section of line or equipment to be worked have been deenergized.
  - (ii) All switches and disconnectors are plainly tagged indicating that men are at work.
  - (iii) Where design of such switches and disconnectors permits, they have been rendered inoperable.
- (c) After all designated switches and disconnectors have been opened, rendered inoperable, and tagged, visual inspection or tests shall be conducted to ensure that equipment or lines have been deenergized.

- (d) Protective grounds shall be applied on the disconnected lines or equipment to be worked on.
- (e) Guards or barriers shall be erected as necessary to adjacent energized lines.
- (f) When more than 1 independent crew requires the same line or equipment to be deenergized, a prominent tag for each such independent crew shall be placed on the line or equipment by the designated employee in charge.
- (g) Upon completion of work on deenergized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear and that protective grounds installed by his crew have been removed, and he shall report to the designated authority that all tags protecting his crew may be removed.

(2) When a crew working on a line or equipment can clearly see that the means of disconnecting from electric energy are visibly open or visibly locked out, the provisions of subdivisions (a) and (b) of this subrule shall apply:

- (a) Guards or barriers shall be erected, as necessary, to adjacent energized lines.
- (b) Upon completion of work on deenergized lines or equipment, each designated employee in charge shall determine that all employees in his crew are clear and that protective grounds installed by his crew have been removed, and he shall report to the designated authority that all tags protecting his crew may be removed.

#### **R 408.41629. Night Work.**

**Rule 1629.** When working at night, spotlights or portable lights for emergency lighting shall be provided as needed to perform the work safely.

#### **R 408.41630. Work over and near water.**

**Rule 1630.** When crews are engaged in work over or near water and when danger of drowning exists, suitable protection shall be provided for pursuant to rules 617 and 636 of construction safety standard, Part 6. Personal Protective Equipment, being R 408.40617 and R 408.40636 of the Michigan Administrative Code.

#### **R 408.41631. Hydraulic Fluids.**

**Rule 1631.** All hydraulic fluids used for the insulated sections of derrick trucks, aerial lifts, and hydraulic tools which are used on or around energized lines and equipment shall be of the insulating type. The requirements for fire-resistant fluids do not apply to hydraulic tools covered by this rule.

#### **R 408.41632. Rubber protective equipment; certification; use and storage.**

**Rule 1632.** (1) Rubber insulating gloves, rubber matting for use around electrical apparatus, rubber insulating blankets, rubber insulating covers, rubber insulating line hose, and rubber insulating sleeves, when purchased after the effective date of this part, shall bear a permanent mark to show the manufacturer's name or trademark and certification of compliance with the appropriate ANSI/ASTM standard as listed in table 2. The following standards listed in table 2 are incorporated herein by reference and may be inspected at the Lansing office of the department of labor. The ANSI/ASTM standards may be purchased as a unit from the American National Standards Institute, 1430 Broadway, New York, New York 10018, or from the American Society of Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 10103. Each of these standards may also be purchased from the Michigan Department of Consumer

and Industry Services, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909, at a cost of \$4.00 each.

(2) Table 2 reads as follows:

TABLE 2

<i>Item</i>	<i>ANSI/ASTM</i>	<i>Cost</i>
Rubber insulating gloves	D-120-77	\$4.00
Rubber matting for use around electrical apparatus	D-178-77	\$4.00
Rubber insulating blankets	D-1048-77	\$4.00
Rubber insulating covers	D-1049-77	\$4.00
Rubber insulating line hose	D-1050-77	\$4.00
Rubber insulating sleeves	D-1051-77	\$4.00

(3) Material other than rubber that offers equivalent or greater protection may be used if the material is certified to meet the appropriate ANSI/ASTM standard tests.

(4) Rubber insulating sleeves and blankets shall be given a visual inspection and an electrical test by a trained employee or outside service within 12 months after purchase and not less than once each 12-month period thereafter.

(5) Rubber insulating gloves shall be given an electrical test by a trained employee or outside service at intervals as prescribed in ANSI/ASTM F496-78, standard specifications for the in-service care of insulating gloves and sleeves, which is incorporated herein by reference and may be inspected at the Lansing office of the Department of Consumer and Industry Services. This standard may be purchased from the American National Standards Institute, 1430 Broadway, New York, New York 10018, or from the American Society of Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 10103, at a cost of \$4.00. The standard may also be purchased from the Safety Standards Division, Bureau of Safety and Regulation, Michigan Department of Consumer and Industry Services, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909, at a cost of \$4.00.

(6) The maximum interval for the electrical retesting of gloves required by ANSI/ASTM F496-78 is shown in table 3.

(7) Table 3 reads as follows:

TABLE 3  
Electrical Retesting of Gloves

<b>Description</b>	<b>Maximum Interval Between Tests</b>
1. Gloves, in use	6 Months
2. Gloves, in use by telecommunication industry	9 Months
3. Gloves, tested but not issued for service	12 Months

NOTE: THE INTERVAL BETWEEN TESTS SHOULD TAKE INTO CONSIDERATION WORK PRACTICES AND TEST EXPERIENCE.

(8) The equipment shall be dated or coded with the date of purchase or issuance and the date of each periodic test. The electrical test shall be performed in accordance with the applicable American national standards institute or American society of testing and materials standard listed in table 2.

(9) Equipment listed in table 2 shall be visually inspected for cracks, cuts, punctures, and thin spots before each use. Where insulating gloves are required and used, they shall be manually air tested daily before starting work.

(10) Equipment not meeting the electrical test requirements, visual inspection, or manual air test for flaws, scuffs, snags, punctures, and foreign substances, such as oil, dirt, or grease, shall be removed from service.

(11) An insulated blanket, glove, or sleeve shall be capable of withstanding the voltage to which it may be subjected.

(12) Insulating gloves, sleeves, and blankets shall be kept as free as possible from ozone, chemicals, heat, oils, solvents, damaging vapors, fumes, electrical discharges, and sunlight. The gloves, sleeves, and blankets shall be stored in a bag, box, container, or compartment that is designed and used exclusively for their storage and shall not be folded, creased, or compressed.

#### **R 408.41633. Head protection.**

**Rule 1633.** (1) A class B helmet for the protection of an employee exposed to voltages of more than 600 volts shall bear a certification by the manufacturer that the helmet is as prescribed in ANSI standard, Z89.2-1971, industrial protective helmets for electrical workers, which is incorporated herein by reference and may be inspected at the Lansing office of the Department of Consumer and Industry Services. This standard may be purchased at a cost of \$3.75 from the American National Standards Institute, 1430 Broadway, New York, New York 10018, or from the Michigan Department of Consumer and Industry Services, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909.

(2) A helmet, provided for and as prescribed in rules 617 and 621 of construction safety standard, Part 6. Personal Protective Equipment, being R 408.40617 and R 408.40621 of the Michigan Administrative Code, shall be used to protect the employee where a hazard or risk of injury exists from falling or flying objects or particles or from other harmful contacts or exposures.

(3) Where there is exposure to electrical contact, helmet liners or wind guards shall not be in contact with the outside shell of the helmet.

#### **R 408.41634. Lineman's belt and safety strap; use.**

**Rule 1634.** (1) A lineman's belt and safety strap shall be provided as prescribed in construction safety standard Part 6. Personal Protective Equipment, being R 408.40601 et seq. of the Michigan Administrative Code, and shall be worn by an employee working on a pole, tower, or other such structure, except where use of the belt and strap creates a greater hazard. If use of the belt and strap creates a greater hazard, other equivalent safeguards shall be used.

(2) A lineman's belt and safety strap shall not be used in a manner that subjects them to a shock load, unless the belt and strap are in compliance with the requirements of a safety belt and lanyard prescribed in construction safety standard, Part 45. Fall Protection, being R 408.44501 et seq. of the Michigan Administrative Code.

(3) A lineman's belt and safety strap shall be inspected before use each day and shall be replaced or repaired if found to be defective.

#### **R 408.41635. Lineman's belt and safety strap; construction.**

**Rule 1635.** A lineman's belt and safety strap shall meet all of the following criteria:

- (a) Hardware for a lineman's belt, safety belt, and safety strap shall be dropforged or pressed steel with a corrosion-resistant finish. The surface shall be smooth and free of sharp edges.
- (b) The hardware shall be constructed to withstand the following tests:

- (i) Buckles, 2,000-pound tensile test with a permanent deformation of not more than 1/64 inch.
  - (ii) D rings, 5,000-pound tensile test without cracking or breaking.
  - (iii) Snaphooks, 5,000-pound tensile test without distortion which would release the keeper. The keeper shall have a spring tension that does not allow the keeper to open with a weight of not less than 4 pounds when the weight is supported on the keeper against the end of the nose.
  - (iv) The corrosion-resistant finish shall meet the requirements of the ASTM B117-73 (1979) 50-hour test published in 1973 and approved in 1979 without change, which is incorporated herein by reference and may be inspected at the Lansing office of the department of consumer and industry services. This standard may be purchased at a cost of \$4.00 from the American Society of Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 10103, or from the Michigan Department of Consumer and Industry Services, 7150 Harris Drive, Box 30643, Lansing, Michigan 48909.
- (c) The cushion part of a lineman's belt shall meet all of the following requirements:
- (i) It shall contain no exposed rivets on the inside.
  - (ii) It shall be not less than 3 inches wide and not less than 5/32 inch thick.
  - (iii) It shall have pocket tabs that extend not less than 1 1/2 inches down and 3 inches back of the inside of the circle of each D ring for riveting on plier or tool pockets. On shifting D belts, the measurement for pocket tabs shall be taken when the D ring section is centered.
- (d) A maximum of 4 tool loops shall be so located on the lineman's belt that 4 inches of the lineman's belt in the center of the back, measured from D ring to D ring, are free of tool loop and other attachments.
- (e) Copper, steel, or equivalent liners shall be used around the bar of D rings to prevent wear between the D ring and the leather or fabric enclosing them.
- (f) All stitching shall be not less than 42-pound weight nylon or equivalent thread and shall be lockstitched. Stitching parallel to an edge shall be not less than 3/16 inch from the edge of the narrowest member caught by the thread.

#### **R 408.41636. Ladders.**

**Rule 1636.** (1) A portable metal or conductive ladder shall be as prescribed in construction safety standard, Part 11. Fixed and Portable Ladders, being R 408.41101 et seq. of the Michigan Administrative Code, and shall not be used near energized lines or equipment except as may be necessary in specialized work, such as in high voltage substations where nonconductive ladders might present a greater hazard than conductive ladders.

(2) A portable metal or conductive ladder shall be prominently marked as conductive and all necessary precautions shall be taken when used in specialized work as prescribed in subrule (1) of this rule.

(3) A hook or other type of ladder used in structures shall be positively secured to prevent the ladder from being accidentally displaced.

#### **R 408.41637. Live-line tools.**

**Rule 1637.** A live-line tool shall be as prescribed in R 408.41969 of construction safety standard, Part 19.

Tools, being R 408.41901 et seq. of the Michigan Administrative Code.

**R 408.41638. Handtools.**

**Rule 1638.** A portable or powered handtool shall be as prescribed in construction safety standard, Part 19 Tools, being R 408.41901 et seq. of the Michigan Administrative Code.

**R 408.41639. Measuring tapes or measuring ropes.**

**Rule 1639.** Measuring tapes or measuring ropes which are metal or contain conductive strands shall not be used when working on or near energized parts.

**R 408.41640. Mechanical equipment generally.**

**Rule 1640.** (1) Visual inspections shall be made of the equipment to determine whether it is in good condition each day the equipment is to be used.

(2) Tests shall be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

(3) An employer shall not use any motor vehicle equipment having an obstructed view to the rear unless 1 of the following is complied with:

- (a) The vehicle has a reverse signal alarm audible above the surrounding noise level.
- (b) The vehicle is backed up only when an observer signals that it is safe to do so.

**R 408.41641. Aerial lifts.**

**Rule 1641.** (1) The provisions of construction safety standard, Part 32. Aerial Work Platforms, being R 408.43201 et seq. of the Michigan Administrative Code, apply to the utilization of aerial lifts.

(2) When working near energized lines or equipment, aerial lift trucks shall be grounded or barricaded and considered as energized equipment, or the aerial lift truck shall be insulated from the work being performed.

(3) Equipment or material shall not be passed between a pole or structure and an aerial lift while an employee working from the basket is within distance of energized conductors or equipment that are not covered with insulating protective equipment.

**R 408.41642. Derrick trucks, cranes, and other lifting equipment.**

**Rule 1642.** (1) All derrick trucks, cranes, and other lifting equipment shall comply with construction safety standards, Part 10. Lifting and Digging Equipment and Part 13. Mobile Equipment, being R 408.41001(a) et seq. and R 408.41301 et seq. of the Michigan Administrative Code, except:

- (a) As stated in Part 10 relating to clearance (for clearances in this rule see table 1).
- (b) That a derrick truck (electric line truck) shall not be required to comply with §1926.550(a)(7)(vi), (a)(17), (b)(2), and (e), as adopted by reference in R 408.41001.
- (2) With the exception of equipment certified for work on the proper voltage, mechanical equipment shall not be operated closer to any energized line or equipment than the clearances set forth in R 408.41627 of this part, unless 1 of the following is complied with:
  - (a) An insulated barrier is installed between the energized part and the mechanical equipment.
  - (b) The mechanical equipment is grounded.
  - (c) The mechanical equipment is insulated.
  - (d) The mechanical equipment is considered energized.

**R 408.41643. Material handling.**

**Rule 1643.** (1) Prior to unloading steel, poles, cross arms, and similar material the load shall be thoroughly examined to ascertain if the load has shifted, binders or stakes have broken, or the load is otherwise hazardous to employees.

(2) During pole hauling operation, all loads shall be secured to prevent displacement and a red flag shall be displayed at the trailing end of the longest pole.

(3) Precautions shall be exercised to prevent the blocking of roadways or the endangering of other traffic.

(4) When hauling poles during the hours of darkness, illuminated warning devices shall be attached to the trailing end of the longest pole.

(5) Materials or equipment shall not be stored under energized bus, energized lines, or near energized equipment, if it is practical to store them elsewhere.

(6) When materials or equipment are stored under energized lines or near energized equipment, applicable clearances shall be maintained as stated in table 1, and extraordinary caution shall be exercised when moving materials near such energized equipment.

(7) Where hazards to employees exist, tag lines or other suitable devices shall be used to control loads being handled by hoisting equipment.

(8) During construction or repair of oil filled equipment, the oil may be stored in temporary containers other than those required in construction safety standard, Part 18. Fire Protection and Prevention, being R 408.41801 et seq. of the Michigan Administrative Code, such as pillow tanks.

(9) During framing operations, employees shall not work under a pole or a structure suspended by a crane, A-frame, or similar equipment unless the pole or structure is adequately supported.

(10) The hoist rope shall not be wrapped around the load. This provision does not apply to electric construction crews when setting or removing poles.

**R 408.41644. Grounding for protection of employees.**

**Rule 1644.** (1) All conductors and equipment shall be treated as energized until tested or otherwise determined to be deenergized or until grounded.

(2) New lines or equipment may be considered deenergized and worked as such where either of the following conditions exists:

- (a) The lines or equipment are grounded.
- (b) The hazard of induced voltages is not present, and adequate clearances or other means are implemented to prevent contact between energized lines or equipment and the new lines or equipment.
- (3) Bare wire communication conductors on power poles or structures shall be treated as energized lines unless protected by insulation materials.
- (4) Deenergized conductors and equipment which are to be grounded shall be tested for voltage. Results of this voltage test shall determine the subsequent procedures as required in R 408.41628 of this part.
- (5) When attaching grounds, the ground end shall be attached first, then the other end shall be attached and removed by means of insulated tools or other suitable devices.
- (6) When removing grounds, the grounding device shall first be removed from the line or equipment by using insulating tools or other suitable devices.
- (7) Grounds shall be placed either between the work location and all sources of energy and as close as practicable to the work location or at the work location. If work is to be performed at more than 1 location on the line section, the line section shall be grounded and short-circuited at 1 location in the line section and the

conductor to be worked on shall be grounded at each work location. The minimum distance shown in table 1 shall be maintained from ungrounded conductors at the work location. Where the making of ground is impracticable, or the conditions resulting therefrom would be more hazardous than working on the lines or equipment without grounding, the grounds may be omitted and the line or equipment worked as energized.

(8) Grounds may be temporarily removed only when necessary for test purposes. Extreme caution shall be exercised during the test procedures.

(9) When grounding electrodes are utilized, the electrodes shall have a resistance to ground low enough to remove the danger of harm to personnel to permit prompt operation of protective devices.

(10) Grounding to a tower shall be made with a tower clamp capable of conducting the anticipated fault current.

(11) A ground lead, to be attached to either a tower ground or driven ground, shall be capable of conducting the anticipated fault current and shall have a minimum conductance of no. 2 AWG copper.

#### **R 408.41645. Overhead lines.**

**Rule 1645.** (1) When working on or with overhead lines, the provisions of subrules (2) to (10) of this rule shall be complied with in addition to other applicable provisions of this part.

(2) Prior to climbing poles, ladders, scaffolds, or other elevated structures, an inspection shall be made to determine that the structures are capable of sustaining the additional or unbalanced stresses to which they will be subjected.

(3) Where poles or structures may be unsafe for climbing, they shall not be climbed until made safe by guying, bracing, or other adequate means.

(4) Before installing or removing wire or cable, strains to which poles and structures will be subjected shall be considered and necessary action taken to prevent failure of supporting structures.

(5) When setting, moving, or removing poles using cranes, derricks, gin poles, A-frames, or other mechanized equipment near energized lines or equipment, precautions shall be taken to avoid contact with energized lines or equipment, except in bare-hand, live line work.

(6) Equipment and machinery operating adjacent to energized lines or equipment shall be in compliance with subrule (2) of R 408.41640.

(7) Unless using suitable protective equipment for the voltage involved, employees standing on the ground shall avoid contacting equipment or machinery working adjacent to energized lines or equipment.

(8) Lifting equipment shall be bonded to an effective ground or it shall be considered energized and barricaded when utilized near energized equipment or lines.

(9) Pole holes shall not be left unattended or unguarded in areas where employees are currently working.

(10) Tag lines shall be a nonconductive type when used near energized lines.

#### **R 408.41646. Metal tower construction.**

**Rule 1646.** (1) When working in an excavation for pad- or pile-type footings in excess of 5 feet deep, the excavation shall be either sloped to the angle of repose or shored as prescribed in construction safety standard, Part 9. Excavation, Trenching and Shoring, being R 408.40901 et seq. of the Michigan Administrative Code. Ladders shall be provided for access to pad- or pile-type footing excavations in excess of 4 feet.

(2) Provisions shall be made for cleaning out auger-type footings without requiring an employee to enter

the footing unless shoring is used to protect the employee.

(3) A designated employee shall be used in directing mobile equipment adjacent to footing excavations.

(4) A person shall not be permitted to remain in the footing while equipment is being spotted for placement.

(5) Where necessary to assure the stability of mobile equipment, the location of use for such equipment shall be graded and leveled.

(6) Tower assembly shall be carried out with a minimum exposure of employees to falling objects when working at 2 or more levels on a tower.

(7) Guy lines shall be used as necessary to maintain sections or parts of sections in position and to reduce the possibility of tipping.

(8) Members and sections being assembled shall be adequately supported.

(9) When assembling and erecting towers, the provisions of subdivisions (a), (b), and (c) of this subrule shall be complied with:

(a) The construction of transmission towers and the erecting of poles, hoisting machinery, site preparation machinery, and other types of construction machinery shall conform to the applicable requirements of this part.

(b) A person shall not be permitted under a tower which is in the process of erection or assembly, except as may be required to guide and secure the section being set.

(c) When erecting towers using hoisting equipment adjacent to energized transmission lines, the lines shall be deenergized when practical. If the lines are not deenergized, extraordinary caution shall be exercised to maintain the minimum clearance distances required by R 408.41627 of this part.

(10) Erection cranes shall be set on firm level foundations and when the cranes are so equipped, outriggers shall be used.

(11) Tag lines shall be utilized to maintain control of tower sections being raised and positioned, except where the use of such lines would create a greater hazard.

(12) The loadline shall not be detached from a tower section until the section is adequately secured.

(13) Except during emergency restoration procedures, erection shall be discontinued in the event of high wind or other adverse weather conditions which would make the work hazardous.

(14) Equipment and rigging shall be regularly inspected and maintained in safe operating condition.

(15) Adequate traffic control shall be maintained when crossing highways and railways with equipment as required by construction safety standard, Part 22. Signals, Signs, Tags and Barricades, being R 408.42201 et seq. of the Michigan Administrative Code.

(16) A designated employee shall be utilized to determine that required clearance is maintained in moving equipment under or near energized lines.

#### **R 408.41647. Stringing or removing de-energized conductors.**

**Rule 1647.** (1) When stringing or removing deenergized conductors, the provisions of subrules (2) to (18) of this rule shall be complied with.

(2) Prior to stringing operations, a briefing for all employees who will be performing the work shall be held setting forth the plan of operation and specifying the type of equipment to be used, grounding devices and procedures to be followed, crossover methods to be employed, and the clearance authorization required.

(3) Where there is a possibility of the conductor accidentally contacting an energized circuit or receiving

a dangerous induced voltage buildup, to further protect the employee from the hazards of the conductor, the conductor being installed or removed shall be grounded or provisions made to insulate or isolate the employee.

(4) If the existing line is de-energized, proper clearance authorization shall be secured and the line grounded on both sides of the crossover or the line being strung or removed shall be considered and worked as energized.

(5) When crossing over energized conductors in excess of 600 volts, rope nets or guard structures shall be installed unless provision is made to isolate or insulate the workman or the energized conductor. Where practical, the automatic reclosing feature of the circuit-interrupting device shall be made inoperative. In addition, the line being strung shall be grounded on either side of the crossover or considered and worked as energized.

(6) Conductors being strung in or removed shall be kept under positive control by the use of adequate tension reels, guard structures, tielines, or other means to prevent accidental contact with energized circuits.

(7) Guard structure members shall be sound and of adequate dimension and strength and adequately supported.

(8) Catch-off anchors, rigging, and hoists shall be of ample capacity to prevent loss of the lines.

(9) The manufacturer's load rating shall not be exceeded for stringing lines, pulling lines, sock connections, and all load-bearing hardware and accessories.

(10) Pulling lines and accessories shall be inspected regularly and replaced or repaired when damaged or when dependability is doubtful. The provisions of R 408.40843(3) of construction safety standard, Part 8. Handling and Storage of Material, shall not apply.

(11) Conductor grips shall not be used on wire rope unless designed for this application.

(12) While the conductor or pulling line is being pulled (in motion), employees shall not be permitted directly under overhead operations or on the crossarm.

(13) A transmission clipping crew shall have a minimum of 2 structures clipped in between the crew and the conductor being sagged. When working on bare conductors, clipping and tying crews shall work between grounds at all times. The grounds shall remain intact until the conductors are clipped in, except on dead-end structures.

(14) Except during emergency restoration procedures, work from structures shall be discontinued when adverse weather, such as high wind or ice on structures, makes the work hazardous.

(15) Stringing and clipping operations shall be discontinued during the progress of an electrical storm in the immediate vicinity.

(16) Reel-handling equipment, including pulling and braking machines, shall have ample capacity, operate smoothly, and be leveled and aligned in accordance with the manufacturer's operating instructions.

(17) Reliable communications between the reel tender and pulling rig operator shall be provided.

(18) Each pull shall be snubbed or dead-ended at both ends before subsequent pulls.

#### **R 408.41648. Stringing adjacent to energized lines.**

**Rule 1648.** (1) Prior to stringing parallel to an existing energized transmission line, a competent determination shall be made to ascertain whether dangerous induced voltage buildups will occur, particularly during switching and ground fault conditions. When there is a possibility that such dangerous induced voltage may exist, the employer shall comply with the provisions of subrules (2)

to (11) of this rule in addition to the provision of R 408.41647 of this part, unless the line is worked as energized.

(2) When stringing adjacent to energized lines, the tension stringing method or other methods which preclude unintentional contact between the lines being pulled and any employee shall be used.

(3) All pulling and tensioning equipment shall be isolated, insulated, or effectively grounded.

(4) A ground shall be installed between the tensioning reel setup and the first structure in order to ground each bare conductor, subconductor, and overhead ground conductor during stringing operations.

(5) During stringing operations, each bare conductor, subconductor, and overhead ground conductor shall be grounded at the first tower adjacent to both the tensioning and pulling setup and in increments so that no point is more than 2 miles from a ground, and all of the following provisions shall be compiled with:

(a) The grounds shall be left in place until conductor installation is completed.

(b) Such grounds shall be removed as the last phase of aerial cleanup.

(c) Except for moving-type grounds, the grounds shall be placed and removed with a hot stick.

(6) Conductors, subconductors, and overhead ground conductors shall be grounded at all dead-end or catch-off points.

(7) A ground shall be located at each side and within 10 feet of working areas where conductors, subconductors, or overhead ground conductors are being spliced at ground level. The 2 ends to be spliced shall be bonded to each other. It is recommended that splicing be carried out on either an insulated platform or on a conductive metallic grounding mat bonded to both grounds. When a grounding mat is used, it is recommended that the grounding mat be roped off and an insulated walkway provided for access to the mat.

(8) All conductors, subconductors, and overhead ground conductors shall be bonded to the tower at any isolated tower where it may be necessary to complete work on the transmission line.

(9) Work on dead-end towers shall require grounding on all de-energized lines.

(10) Grounds may be removed as soon as the work is completed provided that the line is not left open circuited at the isolated tower at which work is being completed.

(11) When performing work from the structures, clipping crews and all others working on conductors shall be protected by individual grounds installed at every work location.

#### **R 408.41649. Live-line, bare-hand work.**

**Rule 1649.** (1) All live-line, bare-hand work shall be performed in accordance with the following requirements:

(a) Employees shall be instructed and trained in the live-line, bare-hand technique and the safety requirements pertinent thereto before being permitted to use the technique on energized circuits.

(b) Before using the live-line, bare-hand technique on energized high-voltage conductors or parts, the employer or authorized representative shall make a check of all of the following:

(i) The voltage rating of the circuit on which the work is to be performed.

(ii) The clearances to ground of lines and other energized parts on which work is to be performed.

(iii) The voltage limitations of the aerial-lift equipment intended to be used.

- (c) Only equipment designed, tested, and intended for live-line, bare-hand work shall be used.
- (d) All work shall be personally supervised by a person trained and qualified to perform live-line, bare-hand work.
- (e) The automatic reclosing feature of circuit interrupting devices shall be made inoperative where practical before working on any energized line or equipment.
- (f) Work shall not be performed during the progress of an electrical storm in the immediate vicinity.
- (g) A conductive bucket liner or other suitable conductive device shall be provided for bonding the insulated aerial device to the energized line or equipment. The employee shall be connected to the bucket liner by the use of conductive shoes, leg clips, or other suitable means, which shall be provided by the employer at no expense to the employee. Where necessary adequate electrostatic shielding for the voltage being worked or conductive clothing shall be provided by the employer at no expense to the employee.
- (h) Only tools and equipment intended for live-line, bare-hand work shall be used, and such tools and equipment shall be kept clean and dry.
- (i) Before the boom is elevated, the outriggers on the aerial truck shall be extended and adjusted to stabilize the truck and the body of the truck shall be bonded to an effective ground or barricaded and considered as energized equipment.
- (j) Before moving the aerial lift into the work position, all controls (ground level and bucket) shall be checked and tested to determine that they are in proper working condition.
- (k) Arm current tests shall be made before starting work each day, each time during the day when higher voltage is going to be worked, and when changed conditions indicate a need for additional tests. Aerial buckets used for bare-hand, live-line work shall be subjected to an arm current test. This test shall consist of placing the bucket in contact with an energized source equal to the voltage to work upon for a minimum time of 3 minutes. The leakage current shall not exceed 1 microampere per kilovolt of nominal line-to-line voltage. Work operations shall be suspended immediately upon any indication of malfunction in the equipment.
- (l) All aerial lifts to be used for live-line, bare-hand work shall have dual controls (lower and upper) as follows:
  - (i) The upper controls shall be within easy reach of the employee in the basket. If a 2-basket type lift is used, access to the controls shall be with easy reach from either basket.
  - (ii) The lower set of controls shall be located near the base of the boom that will permit override operation of equipment at any time.
- (m) Ground level lift controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.
- (n) Before the employee contacts the energized part to be worked on, the conductive bucket liner shall be bonded to the energized conductor by means of a positive connection which shall remain attached to the energized conductor until the work on the energized circuit is completed.
- (o) The minimum clearance distances for live-line, bare-hand work shall be as specified in table 4.

These minimum clearance distances shall be maintained from all grounded objects and from lines and equipment at a different potential than that to which the insulated aerial device is bonded, unless such grounded objects or other lines and equipment are covered by insulated guards. These distances shall be maintained when approaching, leaving, and when bonded to the energized circuit.

- (p) When approaching, leaving or bonding to an energized circuit, the minimum distances in table 4 shall be maintained between all parts of the insulated boom assembly and any grounded parts, including the lower arm or portions of the truck.
- (q) When positioning the bucket alongside an energized bushing or insulator string, the minimum line-to-ground clearances of table 4 shall be maintained between all parts of the bucket and the grounded end of the bushing or insulator string.
- (r) The use of handlines between buckets, booms, and the ground is prohibited.
- (s) Conductive materials over 36 inches long shall not be placed in the bucket, except for appropriate length jumpers, armor rods, and tools.
- (t) Nonconductive-type handlines may be used from line to ground when not supported from the bucket.
- (u) The bucket and upper insulated boom shall not be overstressed by attempting to lift or support weights in excess of the manufacturer's rating.
- (v) A minimum clearance table, as shown in table 4, shall be printed on a plate of durable nonconductive material and mounted in the bucket or its vicinity so as to be visible to the operator of the boom.
- (w) It is recommended that insulated measuring sticks be used to verify clearance distances.
- (2) Table 4 reads as follows:

TABLE 4  
Minimum clearance distances for live-line  
bare-hand work (alternating current)

<i>Distance in feet and inches for maximum voltage</i>		
<i>Voltage range (phase-to-phase) kilovolts</i>	<i>Phase to ground</i>	<i>Phase to phase</i>
2.1 to 15	2 ft. 0 in.	2 ft. 0 in.
15.1 to 35	2 ft. 4 in.	2 ft. 4 in.
35.1 to 46	2 ft. 6 in.	2 ft. 6 in.
46.1 to 72.5	3 ft. 0 in.	3 ft. 0 in.
72.6 to 121	3 ft. 4 in.	4 ft. 6 in.
138 to 145	3 ft. 6 in.	5 ft. 0 in.
161 to 169	3 ft. 8 in.	5 ft. 6 in.
230 to 242	5 ft. 0 in.	8 ft. 4 in.
345 to 362	17 ft. 0 in.	113 ft. 4 in.
500 to 552	111 ft. 0 in.	120 ft. 0 in.
700 to 765	115 ft. 0 in.	131 ft. 0 in.

<sup>1</sup>NOTE: For 345-362 kv., 500-552 kv., and 700-765 kv., the minimum clearance distance may be reduced provided the distances are not made less than the shortest distance between the energized part and a grounded surface.

#### **R 408.41650. Underground lines.**

**Rule 1650.** (1) Appropriate warning signs shall be promptly placed when covers of manholes, hand holes, or vaults are removed. What is an appropriate warning sign is dependent upon the nature and location of the hazards involved.

(2) Before an employee enters a street opening, such as a manhole or an unvented vault, it shall be promptly

protected with a barrier, temporary cover or other suitable guard.

(3) When work is to be performed in a manhole or unvented vault:

- (a) Entry shall not be permitted unless forced ventilation is provided or the atmosphere is found to be safe by testing for oxygen deficiency and the presence of explosive gases or fumes.
- (b) Where unsafe conditions are detected, by testing or other means, the work area shall be ventilated and otherwise made safe before entry.
- (c) Provisions shall be made for an adequate continuous supply of air.
- (4) While work is being performed in manholes, an employee shall be available in the immediate vicinity to render emergency assistance as may be required. This requirement does not preclude the employee in the immediate vicinity from occasionally entering a manhole to provide assistance other than emergency. This requirement also does not preclude a qualified employee, working alone, from entering, for brief periods of time, a manhole where energized cables or equipment are in service, for the purpose of inspection, housekeeping, taking readings, or similar work if such work is performed safely.

(5) When open flames must be used or smoking is permitted in manholes, extra precautions shall be taken to provide adequate ventilation.

(6) Before using open flames in a manhole or excavation in an area where combustible gases or liquids may be present, such as near a gasoline service station, the atmosphere of the manhole or excavation shall be tested and found safe or cleared of the combustible gases or liquids.

(7) During excavation or trenching, in order to prevent the exposure of employees to the hazards created by damage to dangerous underground facilities, efforts shall be made to determine the location of such facilities and work conducted in a manner designed to avoid damage.

(8) Trenching and excavation operations shall comply with construction safety standard, Part 9. Excavation, Trenching and Shoring, being R 408.40901 et seq. of the Michigan Administrative Code.

(9) When underground facilities (electric, gas, water, telephone, or other), are exposed they shall be protected as necessary to avoid damage.

(10) Where multiple cables exist in an excavation, cables other than the one being worked on shall be protected as necessary.

(11) When multiple cables exist in an excavation, the cable to be worked on shall be identified by electrical means unless its identity is obvious by reason of distinctive appearance.

(12) Before cutting into a cable or opening a splice, the cable shall be identified and verified by the employer or authorized representative to be the proper cable.

(13) When working on buried cable or on cable in manholes, metallic sheath continuity shall be maintained by bonding across the opening or by equivalent means.

## CONSTRUCTION IN ENERGIZED SUBSTATIONS

### **R 408.41651. Work near energized equipment facilities.**

**Rule 1651.** (1) When construction work is performed in an energized substation, authorization shall be obtained from the designated authorized person before work is started.

(2) When work is to be done in an energized substation, the following shall be determined:

- (a) What facilities are energized.
- (b) What protective equipment and precautions are necessary for the safety of personnel.

(3) Extraordinary caution shall be exercised in the handling of busbars, tower steel, materials, and equipment in the vicinity of energized facilities. The requirements set forth in R 408.41627 of this part shall be complied with.

### **R 408.41652. Deenergized equipment or lines.**

**Rule 1652.** When it is necessary to deenergize equipment or lines for protection of employees, the requirements of R 408.41628 of this part shall be complied with.

### **R 408.41653. Barricades and barriers.**

**Rule 1653.** (1) Barricades or barriers shall be installed to prevent accidental contact with energized lines or equipment.

(2) Where appropriate, signs indicating the hazard shall be posted near the barricade or barrier. These signs shall comply with construction safety standard, Part 22. Signals, Signs, Tags and Barricades, being R 408.42201 et seq. of the Michigan Administrative Code.

### **R 408.41654. Control panels.**

**Rule 1654.** (1) Work on or adjacent to energized control panels shall be performed by designated employees.

(2) Precaution shall be taken to prevent accidental operation of relays or other protective devices due to jarring, vibration, or improper wiring.

### **R 408.41655. Mechanized equipment.**

**Rule 1655.** (1) Use of vehicles, gin poles, cranes, and other equipment in restricted or hazardous areas shall at all times be controlled by designated employees.

(2) Fenders shall not be required for lowboys used for transporting large electrical equipment, transformers, or breakers.

### **R 408.41656. Storage.**

**Rule 1656.** The storage requirements of subrules (5) and (6) of R 408.41643 of this part, shall be complied with.

### **R 408.41657. Substation fences.**

**Rule 1657.** (1) When a substation fence must be expanded or removed for construction purposes, a temporary fence affording similar protection, when the site is unattended, shall be provided. Adequate interconnection with ground shall be maintained between temporary fence and permanent fence.

(2) All gates to all unattended substations shall be locked, except when work is in progress.

### **R 408.41658. External load helicopters.**

**Rule 1658.** In all operations performed using a rotorcraft for moving or placing external loads, the provisions of §1926.551, as adopted by reference in R 408.41001 of construction safety standard, Part 10. Lifting and Digging Equipment, shall be complied with.